Title: Drive The Data Derby

Brief Overview:

This unit introduces the concepts of comparing data by designing cars and measuring the distance they travel on a level surface and an inclined track. Students deepen their understanding of creating and interpreting bar graphs. Students use understanding of statistics to determine which average (mean, median, mode) to use in a given situation.

NCTM Content Standard:

Students should collect data using observations, surveys, and experiments; represent data using tables and graphs such as line plots, bar graphs, and line graphs.

Students should use measure of center, focusing on the median, and understand what each does and does not indicate about the data set; compare different representation of the same data and evaluate how well each representation show important aspects of the data.

Students should propose and justify conclusions and predictions that are based on data and design studies to further investigate the conclusions or predictions.

Standard 4.0 Knowledge of Statistics
Topic A. Data Displays
Indicator 1. Collect, organize, and display data
Objective d. Organize and display data to make single bar graphs using a variety of categories and intervals.

Topic B. Data Analysis
Indicator 1. Analyze data
Objective c. Interpret data contained in single bar graphs using a variety of categories and intervals.

Grade/Level:

Grade 3/4

Duration/Length:

Three 60 minute lessons

Student Outcomes:

Students will:

- Collect data to compare and contrast the information with their peers.
- Create a bar graph to display the data.
- Interpret data from a bar graph using the average.

Materials and Resources:

Day 1

- Student resource - Bar Graph pre-assessment
- Teacher resource – Bar Graph pre-assessment
- Book – Racecar Driver's Night Before Christmas by Una Belle Townsend (**ISBN-10:** 1589805658 **ISBN-13:** 978-1589805651)
- Racecar Driver's Night Before Christmas summary
- Chart paper
- Teacher Resource - Pictures of teacher vehicle model (2)
- Possible vehicle supplies/materials – straws, index cards, tin foil, tissue paper, plastic grocery store bags, coffee stirrers, popsicle sticks, wax paper, scraps of gift wrapping paper, tape, cereal boxes/tissue boxes, paper cups, milk cartons, tooth picks and glue
- Table top fan
- Graph paper or graph wipe off board
- Student resource – What are the Parts of a Bar Graph?
- Teacher resource – What are the Parts of a Bar Graph?
- Student resource – Tell about the Data!
- Teacher resource – Tell about the Data!
- Student resource – Exit Slip Day 1
- Teacher resource – Exit Slip Day 1

Day 2

- Teacher Resource Animated Race Track http://thedailyrecord.com/wp-files/interactive/construction.swf
- Graph paper or graph wipe off board
- Student resource - Student Lunch Choices tally chart
- Teacher resource - Student Lunch Choices tally chart
- Student resource – What do you know about the AVERAGE?
- Teacher resource – What do you know about the AVERAGE?
- Student resource – Day 2 Exit Slip
- Teacher resource – Day 2 Exit Slip

Day 3

- Unifix cubes
- Graph paper or graph wipe off board
- Student resource – 7 Cards Directions
- Student resource – Exit Slip Day 3
- Teacher resource – Exit Slip Day 3

- Student resource – Summative Assessment
- Teacher resource – Summative Assessment

Development/Procedures:

Day 1

Pre-assessment

- Distribute a copy of the Bar Graph pre-assessment. The students will use prior knowledge to assess their understanding of graphs and data. An answer key is provided.

Engagement

- Read– Racecar Driver's Night Before Christmas by Una Belle Townsend (**ISBN-10:** 1589805658 **ISBN-13:** 978-1589805651)

Exploration

- Ask: What would be the best way to organize data to compare the distance traveled by each car in the race? Answer: Bar Graph
- Discuss and record responses on a large chart.
- Make predictions about the distances vehicles designed and created by student teams will travel?
- Discuss and record student responses.

Explanation

- Drive the Data Derby toy company is looking for new designs for vehicles. The toy company is looking for the vehicle that travels the greatest distance. In groups of 4, students will create vehicles and then compare the distance each vehicle travels to determine which vehicle design should be sent to the toy company.
- Show pictures of the teacher vehicle model.
- Demonstrate how to use straws as wheels for student created vehicles (The straws need to be 4 inches apart.).
- Use duct tape to attach fishing line to a ruler. Two lines the same length should be attached at the other end to a second ruler.
- Present a variety of materials available to create vehicles.
- Organize students in groups of four.
- Create a vehicle using materials/supplies provided that will travel the greatest distance.
- Test the teacher created vehicle on the course 4 times using a small table top fan using variable speeds.

Extension

- Create bar graph on graph paper or graph wipe off board using data collected from the test runs.
- Share and discuss the data related to the bar graph. Be sure to include how to determine the average (mode, mean, and median.)

Differentiation

- Reteach
  - Use TAILS (title, axis, intervals, labels, and scale) to highlight important data on What are the Parts of a Bar Graph? Worksheet. An answer key is provided.

- Enrich
  - Have students interpret a double bar graph, Tell about the Data! Worksheet. An answer key is provided.

Evaluation

- Complete the Day 1 Exit Slip. Write 3 sentences to describe the bar graph.
- Collect the bar graphs completed on Day 1.

Day 2

Engagement

- Show Teacher Resource Animated Race Track found on the following website: http://thedailyrecord.com/wp-files/interactive/construction.swf

Exploration

- Ask: How does adding variables such as an energy source or incline/slope affect the distance travelled by vehicles designed and created by student teams?
- Share and record student responses.

Explanation

- Each team will use a fan to propel their vehicle on a flat surface and record the distance on the board.
- After each group records their data, the class will create a bar graph on graph paper or graph wipe off boards showing the results of the distance each team's vehicle travelled.
- Each graph should include TAILS (title, axis, intervals, labels, and scale).
- Repeat vehicle test run after elevating the track.

Extension

- Create a double bar graph to compare the data collected on the distance the vehicle travelled on a flat surface and on an incline track.

Differentiation

- Reteach

- Form a small group to create a bar graph using the data from the Student Lunch Choices tally chart. An answer key is provided.

- Enrich
  - Complete the What do you know about the AVERAGE? Worksheet. Explain and find the range and mean of the data (Pre-assessment for Day 3). An answer key is provided.

Evaluation

- Have students complete the Day 2 Exit Slip. Have students write three sentences to describe the bar graph.
- Collect the bar graphs completed on Day 2.

Day 3

Engagement

- Each student should grab a large handful of unifix cubes. Instruct students to connect the cubes together to make a bar. On the floor, use tape to create the X axis of a bar graph. Students should put their bars on the floor to create a class bar graph.

Exploration

- Ask: Look at the bars on the floor and determine the average number of cubes each student grabbed.
- How did you determine your answer?

Explanation

- The average can be communicated as the mean, median, or mode. It's the job of data analyzers to decide if the average or typical result is best represented by the mean, median, or mode of the data.
- Using the unifix cubes, model how to calculate the median, mode, and mean without paper and pencil.
- Demonstrate the algorithm for find the mean (Find the sum of the addends and divide by the total number of addends.).
- Ask: What is the average distance each group's vehicle travelled on a level surface? Incline track? Calculate the range, median, mode, and mean the level surface.
- Review and compare predictions completed on Day 1.

Extension

- Calculate the range, median, mode, and mean of the data gathered using the incline track.

Differentiation

- Reteach
    - Form a small group and collect data concerning the number of jumping jacks a student can complete in one minute.
    - Use this data to create a class bar graph and calculate the range, median, mode, and mean.
- Enrich
    - Students will enrich the skills learned by playing the game, 7 Cards (See attached directions.).

Evaluation

- Turn in completed range, median, mode, and mean data for each graph (flat track and incline track).
- Direct student to complete an exit slip: Does the median, mode, or mean best interrupt the data to show the typical results?

Summative Assessment:

- Distribute a copy of the Bar Graph summative assessment. The students will use knowledge learned during this unit to assess their understanding of graphs and data. An answer key is provided.

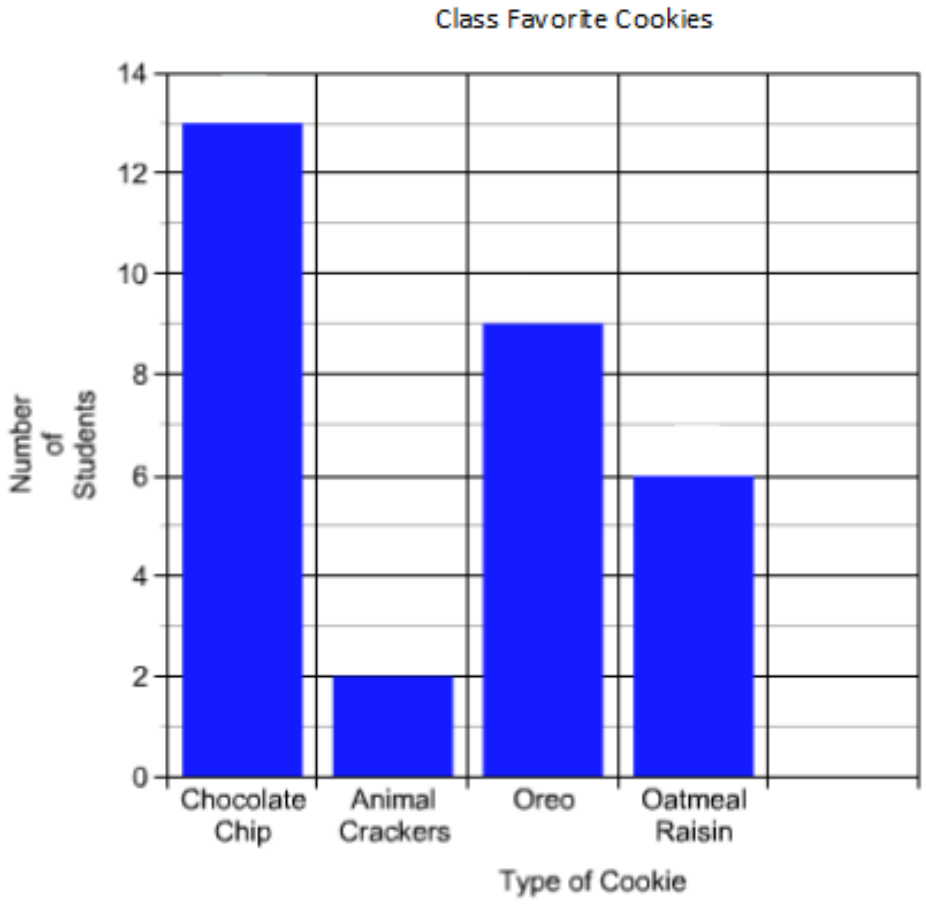
Authors:

Donna LeBlanc
Meadowvale Elementary School
Harford County Public Schools

Nicole Brown
Elmwood Elementary School
Baltimore County Public Schools

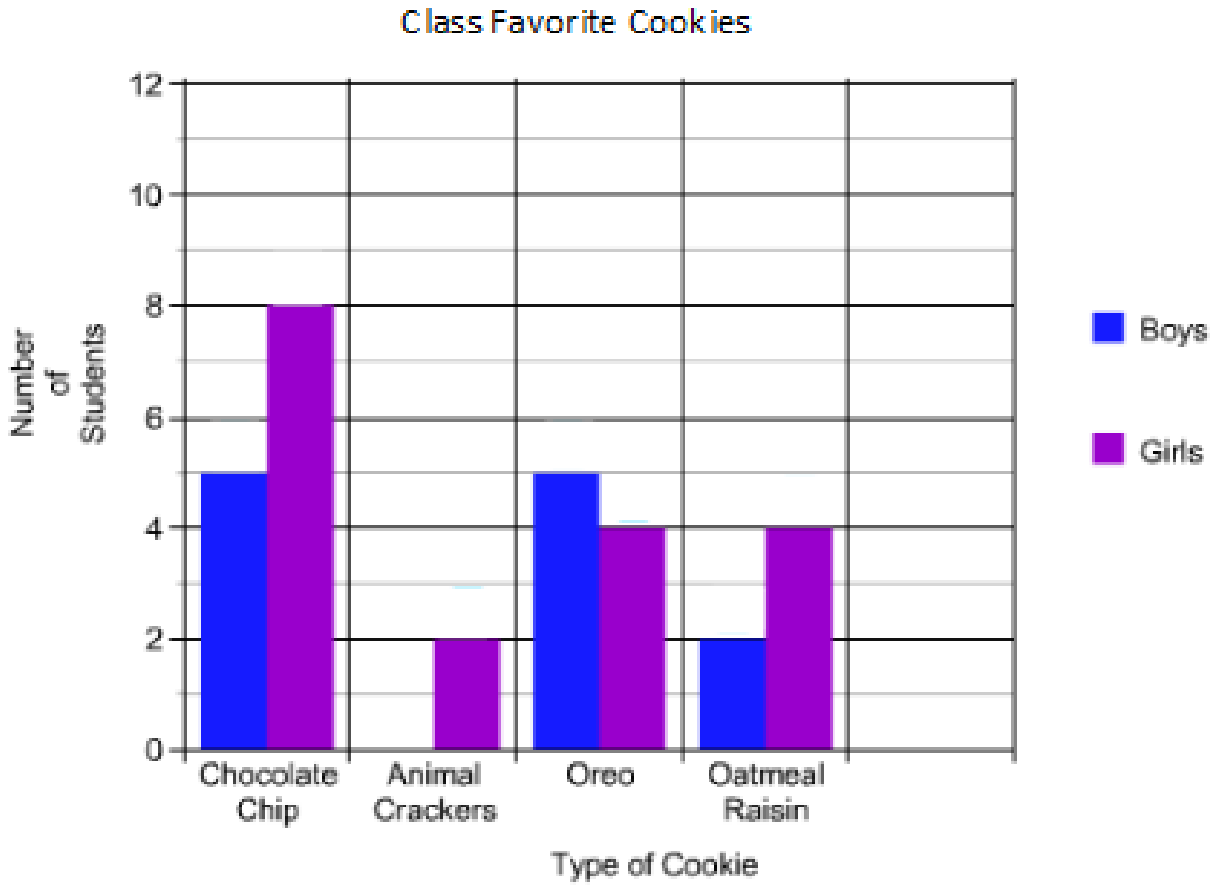
Name _____ Date _____

Drive the Data Derby Pre-Assessment



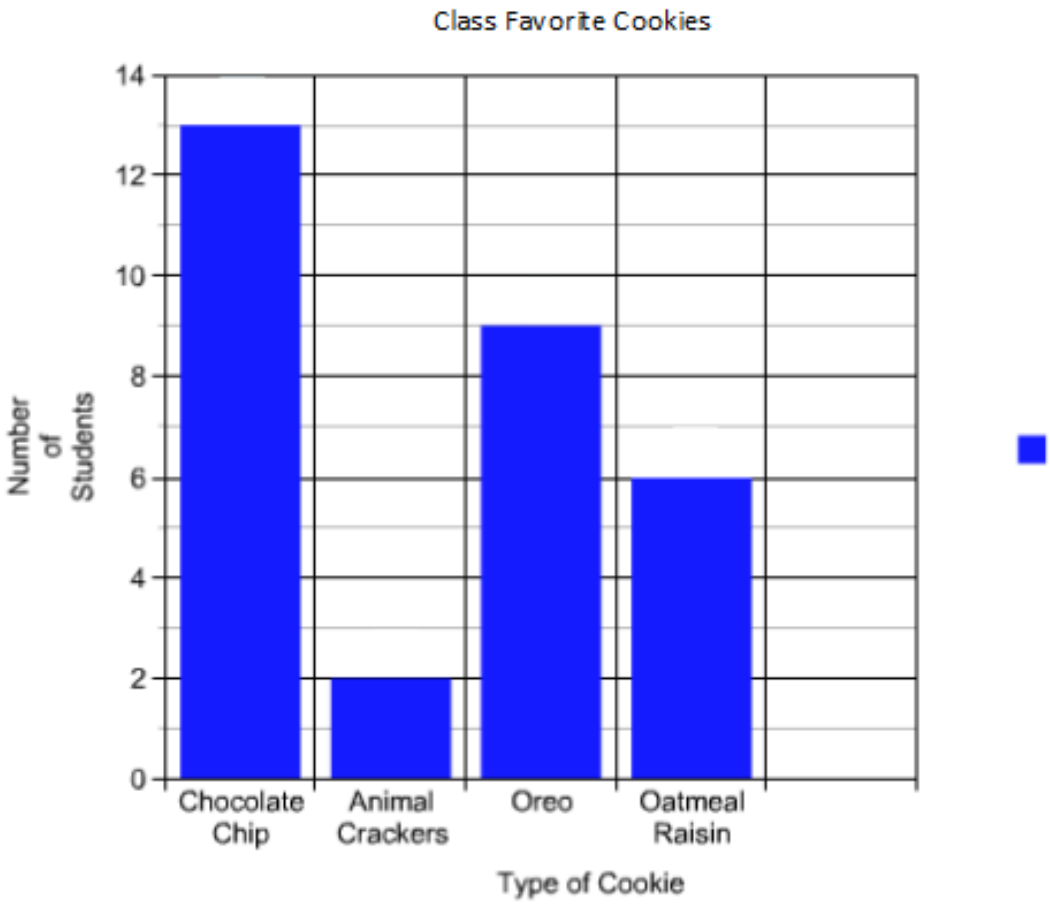
Questions

1. Which is the least favorite cookie? _____
2. How many students chose Oatmeal Raisin cookies as their favorite? _____
3. How many students were surveyed altogether? _____



1. How many more girls prefer chocolate chip cookies than boys? _____
2. If 2 more boys chose Oreo cookies, how many students altogether would prefer Oreos?_____
3. What is the difference between the number of students who prefer Oatmeal Raisin cookies to Animal Crackers? _____

ANSWER KEY

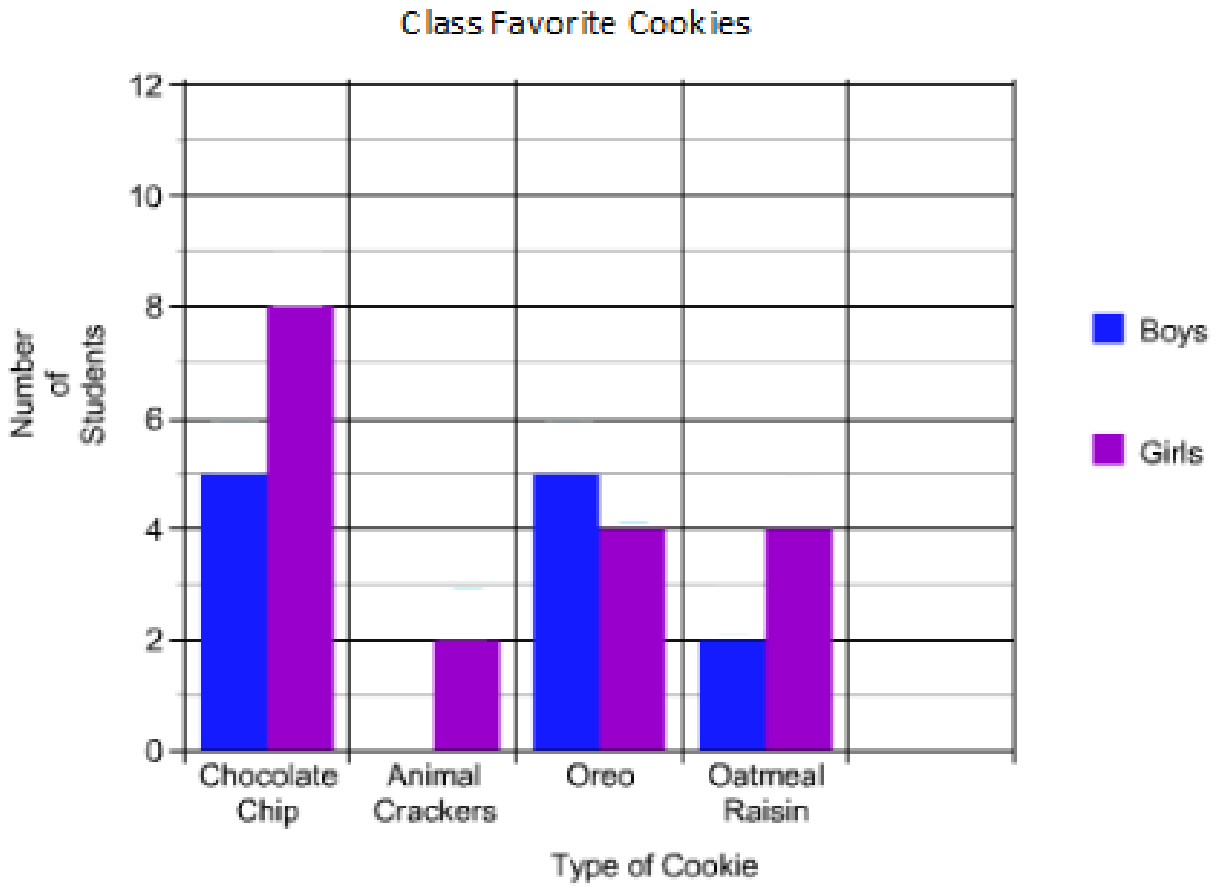


Questions

1. Which is the least favorite cookie? **Animal Crackers**

2. How many students chose Oatmeal Raisin cookies as their favorite? **6**

3. How many students were surveyed altogether? **13+2+9+6=30**



4. How many more girls prefer Chocolate Chip cookies than boys? **8-5=3**

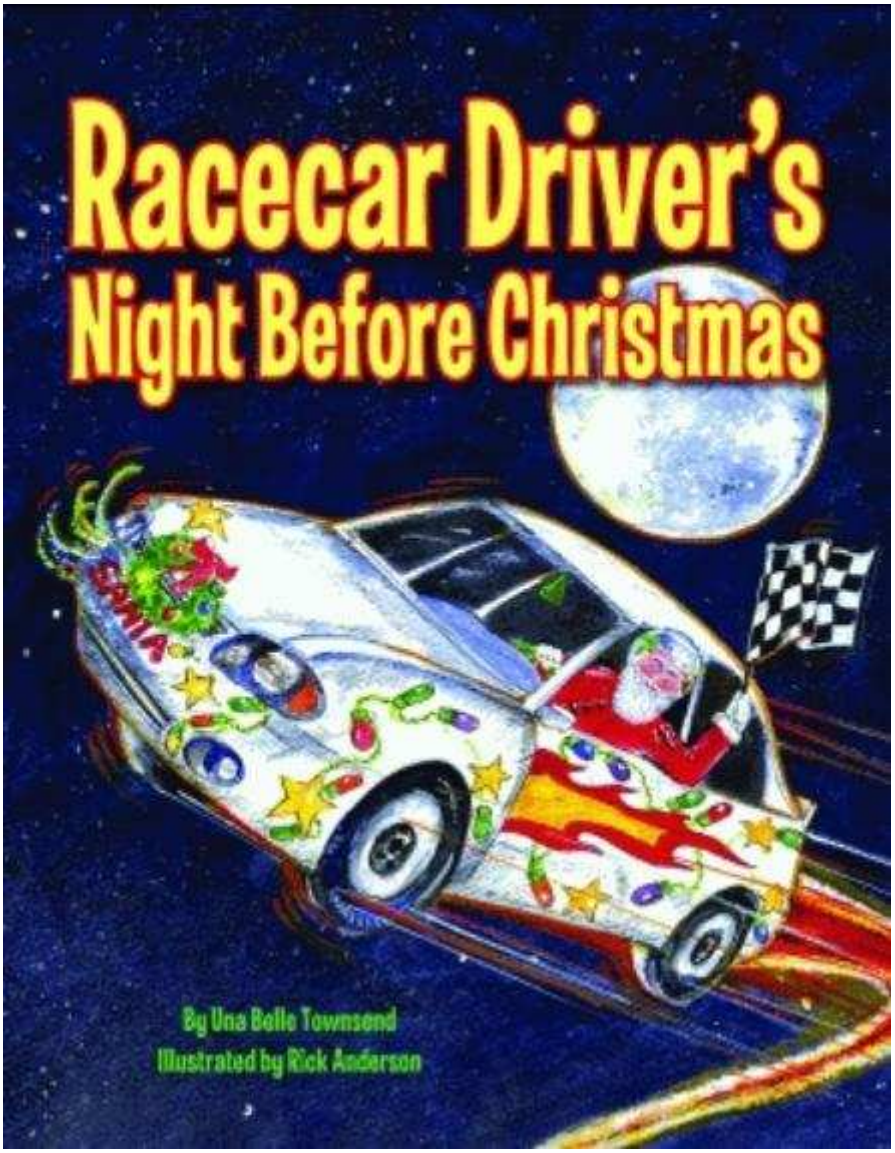
5. If 2 more boys chose Oreos, how many students altogether would prefer Oreos? **2+5+4=11**

6. What is the difference between the number of students who prefer Oatmeal Raisin cookies to Animal Crackers? **(2+4) – 2=4**

It's Christmas Eve morning on the track, and the fans are filling the stands to watch a special holiday race. Everything is going according to plan, but as the drivers begin to enter the track, a new car pulls up, ready to join the Christmas competition.

It's Santy Claus, and he's prepared for anything with his tinsel-covered racecar and his red, fireproof suit. On his helmet are paintings of delicious fudge and bon bons that look good enough to eat. Santy's traveled across the globe and back, all in one night, but this Christmas Eve, here on the track, old Saint Nick is in for a challenge.

With peppermint candies and jingle bells rolling around the car, Santy must outrace the best drivers in the league. Colorful illustrations bring the story to life and add to the excitement as Santy must overcome flying debris to win this race. Exciting and hilarious, ***Racecar Night Before Christmas*** is a perfect addition to the ***Night Before Christmas Series*** and any holiday collection.

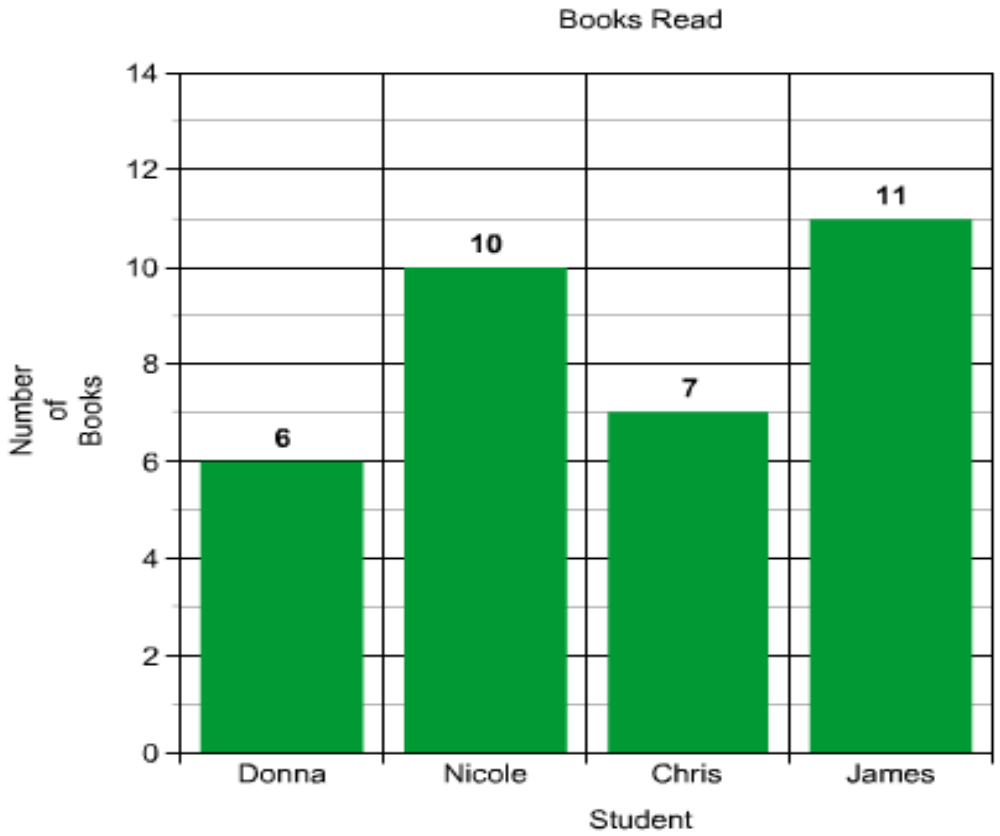


ISBN-10: 1589805658 **ISBN-13:** 978-1589805651

Name: _____ Date: _____

What are the Parts of a Bar Graph?

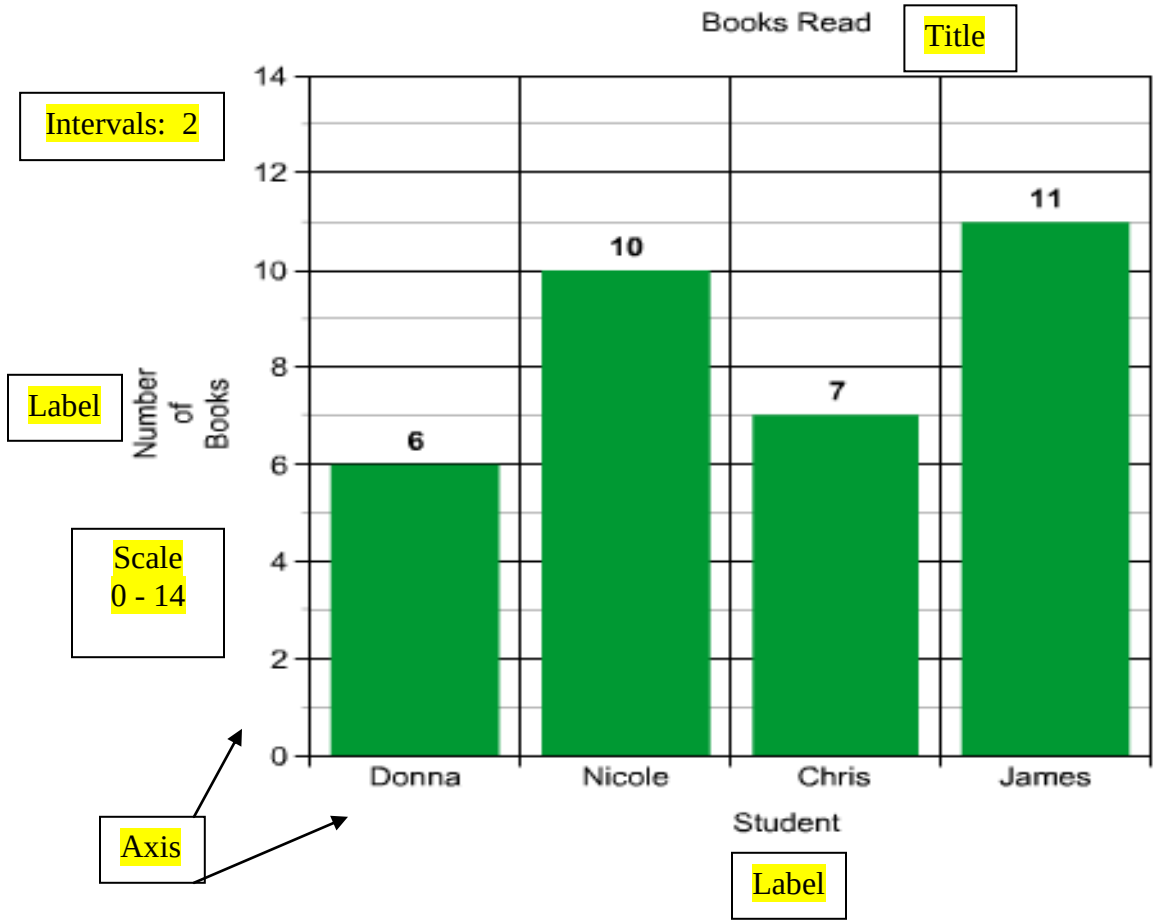
Directions: Highlight and label the TAILS (title, axis, intervals, labels, and scale) of the bar graph below.



Name: _____ Date: _____

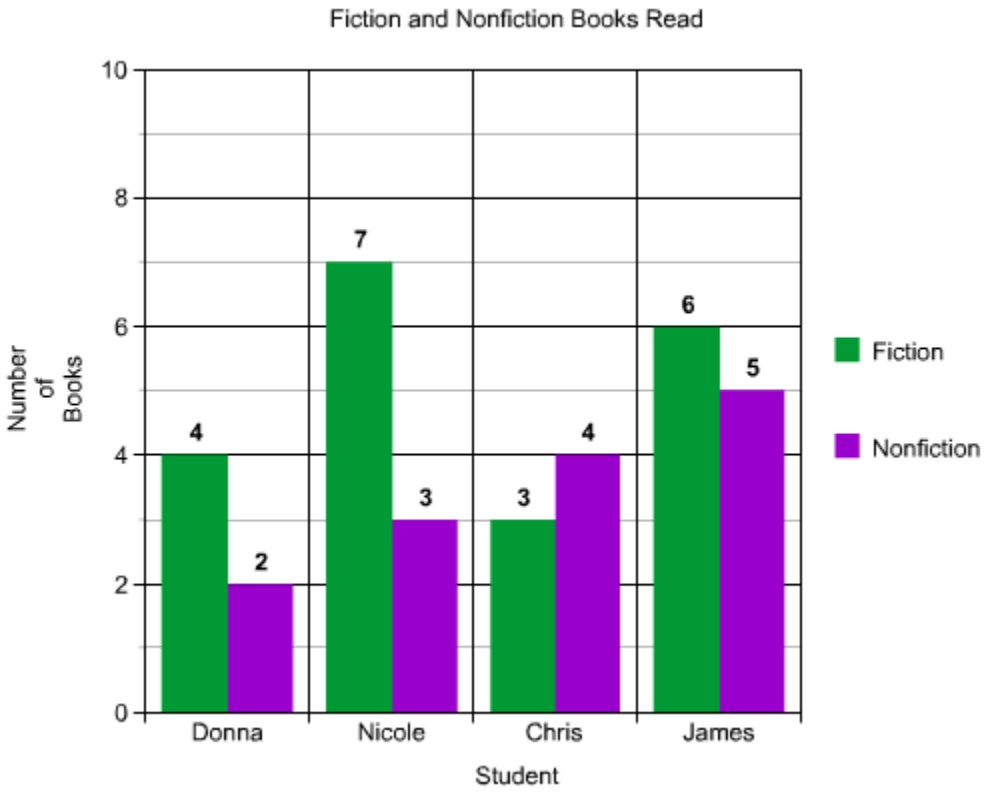
What are the Parts of a Bar Graph?

Directions: Highlight and label the TAILS (title, axis, intervals, labels, and scale) of the bar graph below.



Name: _____ Date: _____

Tell about the Data!



Directions: Answer the following questions about the data above.

1. How many books did the students read altogether?

   _____

2. How many more fiction books did Nicole read than nonfiction books?

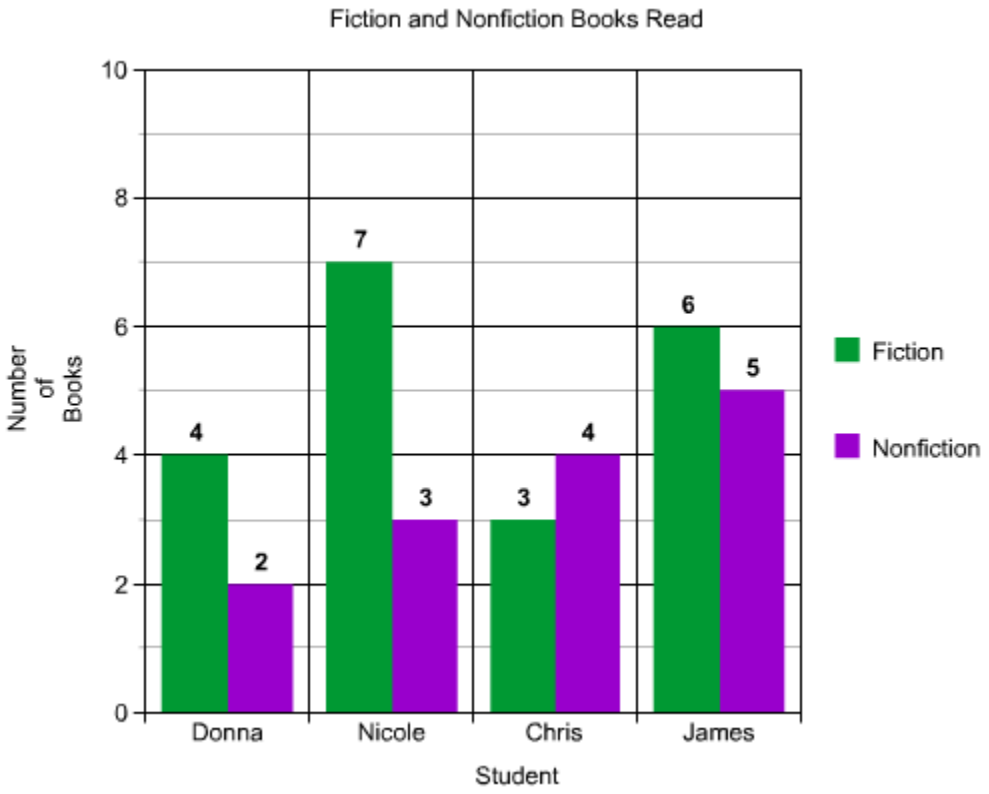
   _____

3. Which student read more nonfiction books than fiction books?

   _____

Name: _____ Date: _____

ANSWER KEY – Tell about the Data



Directions: Answer the following questions about the data above.

1. How many books did the students read altogether?

   34 books

2. How many more fiction books did Nicole read than nonfiction books?

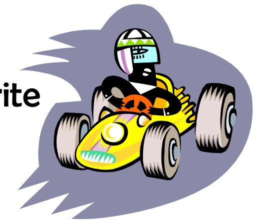
   4 books

3. Which student read more nonfiction books than fiction books?

   Chris

Name: ______________________________ Date: ____________

Day 1 Exit Slip



Directions: Describe any conclusions you can draw based upon the data. Write 3 or more sentences to describe the Teacher Vehicle Test Runs bar graph.

____

____

____

____

✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂

Name: ______________________________ Date: ____________

Day 1 Exit Slip

Directions: Describe any conclusions you can draw based upon the data. Write 3 or more sentences to describe the Teacher Vehicle Test Runs bar graph.

____

____

____

____

Name: _____ Date: _____

Day 1 Exit Slip

Directions: Describe any conclusions you can draw based upon the data. Write 3 or more sentences to describe the Teacher Vehicle Test Runs bar graph.

Answers may vary!

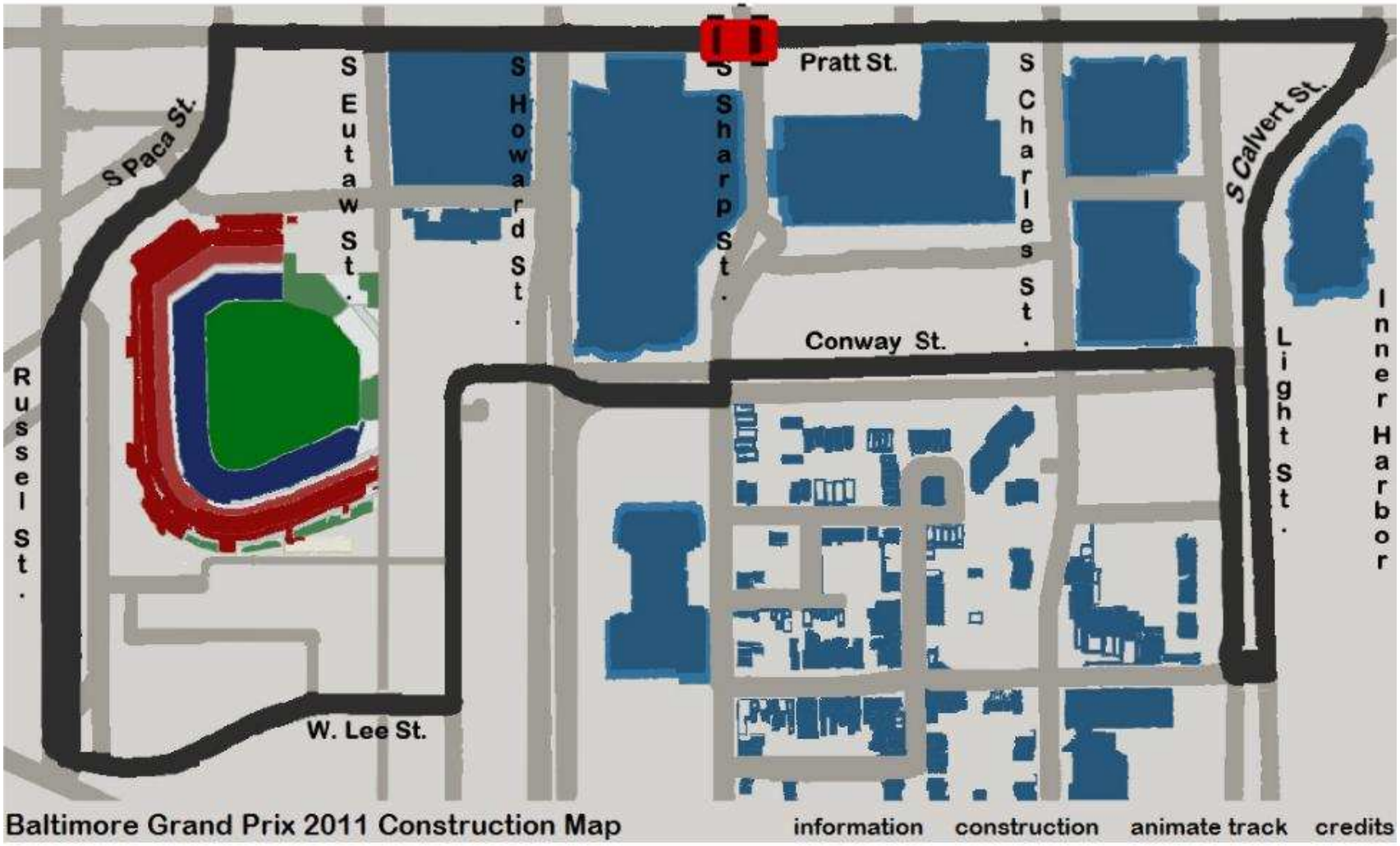
Name: _____ Date: _____

Day 1 Exit Slip

Directions: Describe any conclusions you can draw based upon the data. Write 3 or more sentences to describe the Teacher Vehicle Test Runs bar graph.

Answers may vary!

[Animated Race Track]



Labor Day Weekend, Baltimore Grand Prix

http://thedailyrecord.com/wp-files/interactive/construction.swf

Name: _____ Date: _____

Part I Directions: Use the data from the tally chart to complete a bar graph.

Student Lunch Choices

Lunch Choices	Number of Students
Packer	𝍸 I
Lunch 1 – Pizza	𝍸 𝍸
Lunch 2 – Tuna Salad	III
Lunch 3 – Chicken Nuggets	𝍸

Part II Directions: Write three statements to tell about the data.

_____

_____

_____

_____

_____

_____

Name: _____ Date: _____

ANSWER KEY

Part I Directions: Use the data from the tally chart to complete a bar graph.

Student Lunch Choices

Lunch Choices	Number of Students
Packer	𝍸 I
Lunch 1 – Pizza	𝍸 𝍸
Lunch 2 – Tuna Salad	III
Lunch 3 – Chicken Nuggets	𝍸

Part II Directions: Write three statements to tell about the data.

Answers May Vary

The data is about student lunch choices. There are 4 lunch choices.

Students could pack their lunch or buy pizza, tuna salad, or chicken nuggets. Pizza was bought most by students. Tuna salad was bought least by students.

Name: _____ Date: _____

What do you know about the AVERAGE?

Directions: Answer the following questions in complete sentences.

1. How do you find the range of data? _____

   _____

2. What is the range of the bar graph above? _____

   _____

3. How do you find the mean of data? _____

   _____

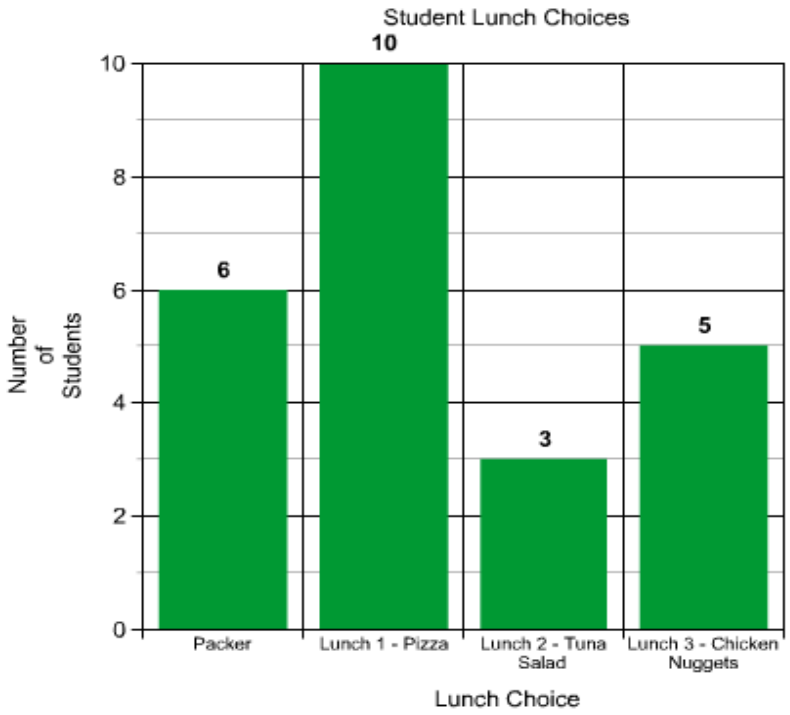
4. What is the mean of the bar graph above? _____

   _____

Name: _____ Date: _____

What do you know about the AVERAGE?

ANSWER KEY



Directions: Answer the following questions in complete sentences.

1. How do you find the range of data?

   Find the difference between the largest amount of students and the smallest amount of students.

2. What is the range of the bar graph above?

   10 – 3 = 7 Range = 7

3. How do you find the mean of data?

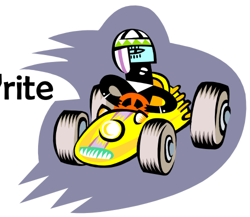
   Example 1 – Find the sum of the data. Divide by the number of addends.
   Example 2 – Use unifix cubes to make each bar. Rearrange the cubes until each bar has the same number of cubes.

4. What is the mean of the bar graph above?

   6 + 10 + 3 + 5 = 24 24 ÷ 4 = 6
   Mean = 6

Name: ______________________________ Date: ____________

Day 2 Exit Slip



Directions: Describe any conclusions you can draw based upon the data. Write 3 or more sentence to describe the Distance Vehicles Travelled bar graph.

____

____

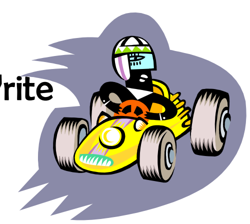
____

____

✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂✂

Name: ______________________________ Date: ____________

Day 2 Exit Slip



Directions: Describe any conclusions you can draw based upon the data. Write 3 or more sentence to describe the Distance Vehicles Travelled bar graph.

____

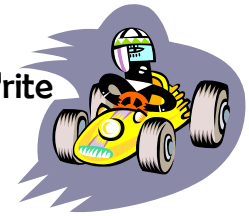
____

____

____

Name: _____ Date: _____

Day 2 Exit Slip

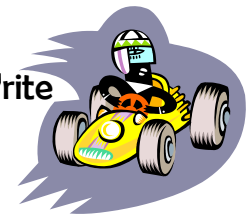


Directions: Describe any conclusions you can draw based upon the data. Write 3 or more sentence to describe the Distance Vehicles Travelled bar graph.

Answers may vary!

Name: _____ Date: _____

Day 2 Exit Slip



Directions: Describe any conclusions you can draw based upon the data. Write 3 or more sentence to describe the Distance Vehicles Travelled bar graph.

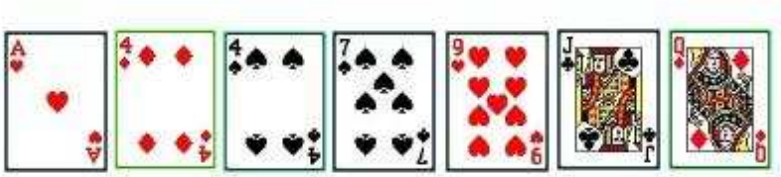
Answers may vary!

7 Cards

Materials: 1 deck of playing cards
2-4 Players
Object of the game: Player with the highest score wins

1. One player deals 7 cards, face down to each player. Point values: Ace= 1 point, Number cards= number value on card, Jack, Queen, King= 10 points
2. Players place cards in order from least to greatest, face up. Player on dealer's left begins by determining his/her mode. Continue to the left until all have listed their mode on their scorecard.
3. Using the same 7 cards, students determine the range and list on their scorecard.
4. Using the same 7 cards, students determine the median and list on their scorecard.
5. Using the same 7 cards, students determine the mean (to the closest whole number) and list on their scorecard.
6. Students total their scores. Highest score wins. If another player challenges the answer of an opponent at any point, other players verify. If correct, player who challenged answer loses that number of points. If incorrect, player whose hand is challenged loses that number of points.

Player	Mode	Range	Median	Mode	Total



Sample Hand

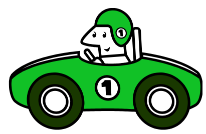
Reordered cards

Mode= 4, Range= 10-1=9, Median=7, Mean= 1+4+4+7+9+10+10=45, 45÷7= 6 Player's total= 4+9+7+6=26

Name: ______________________________ Date: ____________________

Exit Slip Day 3

Directions: Use the Distance Vehicles Travelled double bar graph to answer the following question.

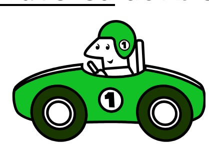


What is the relationship between vehicles travelling on a flat surface and vehicles travelling on an incline track?

Name: ______________________________ Date: ____________________

Exit Slip Day 3

Directions: Use the Distance Vehicles Travelled double bar graph to answer the following question.



What is the relationship between vehicles travelling on a flat surface and vehicles travelling on an incline track?

Name: _____ Date: _____

ANSWER KEY

Exit Slip Day 3

Directions: Use the Distance Vehicles Travelled double bar graph to answer the following question.

What are the similarities and differences between vehicles travelling on a flat surface and vehicles travelling on an incline track?

Each vehicle travels farther on a flat surface than an incline track. Each vehicle travels a different distance.

Name: _____ Date: _____

ANSWER KEY

Exit Slip Day 3

Directions: Use the Distance Vehicles Travelled double bar graph to answer the following question.

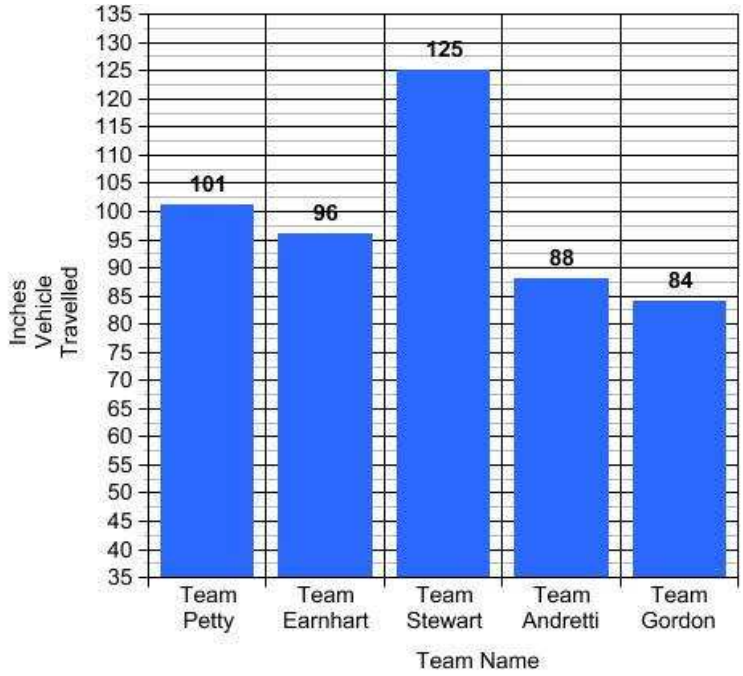
What are the similarities and differences between vehicles travelling on a flat surface and vehicles travelling on an incline track?

Each vehicle travels farther on a flat surface than an incline track. Each vehicle travels a different distance.

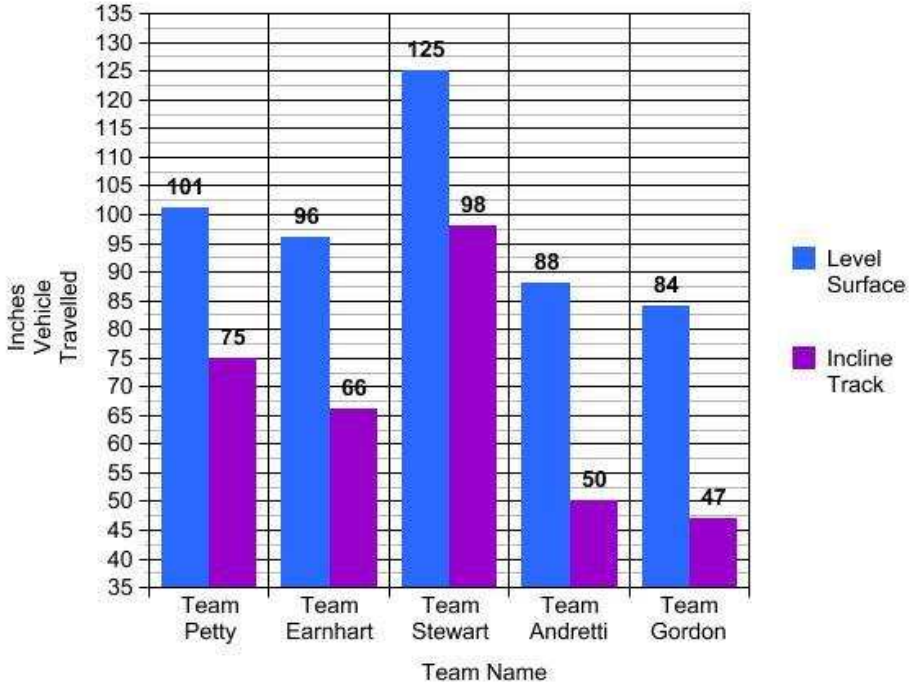
Name _____ Date _____

Assessment: Bar Graphs

Distance Vehicles Travelled on Level Surface



Distance Vehicles Travelled



Use the single and double bar graphs in order to answer the following questions:

1. How much farther did Team Petty travel over Team Gordon on a level surface?

   _____

2. What is the combined distance of the two teams who travelled the shortest distance on the inclined track? _____

3. What is the difference between the longest distance travelled on a level surface and the shortest distance travelled on an inclined track? _____

4. Which team's vehicle traveled the farthest on the level surface?

5. How much farther did Team Stewart's vehicle travel on a level surface compared to an inclined track? _____

Step A

What is the typical distance a vehicle travelled on an inclined track? Explain which type of average you used and explain why this makes sense.

_____

Step B

Explain why your answer is correct (OR HOW YOU FOUND YOUR ANSWER).
Use what you know about interpreting data in your explanation.
Use math vocabulary words and/or numbers in your explanation.

_____

_____

_____

_____

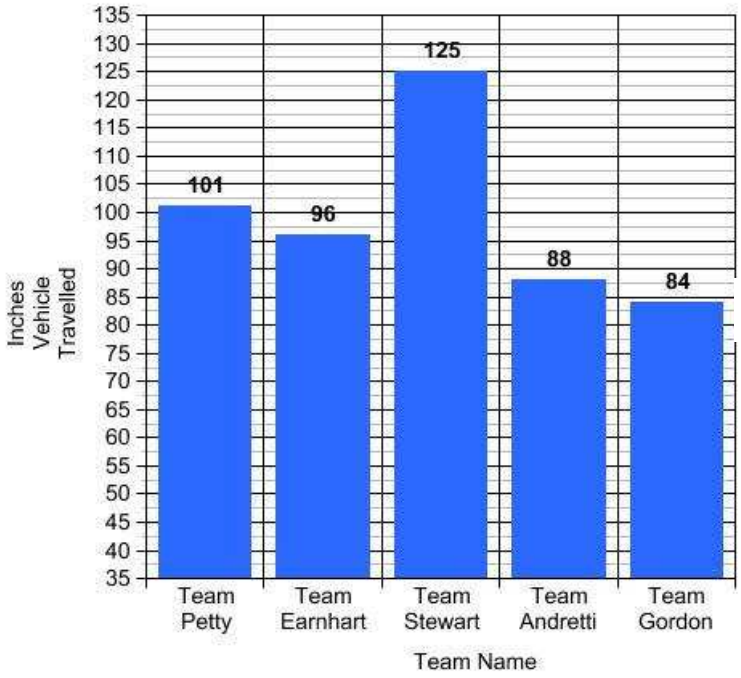
_____

ANSWER KEY

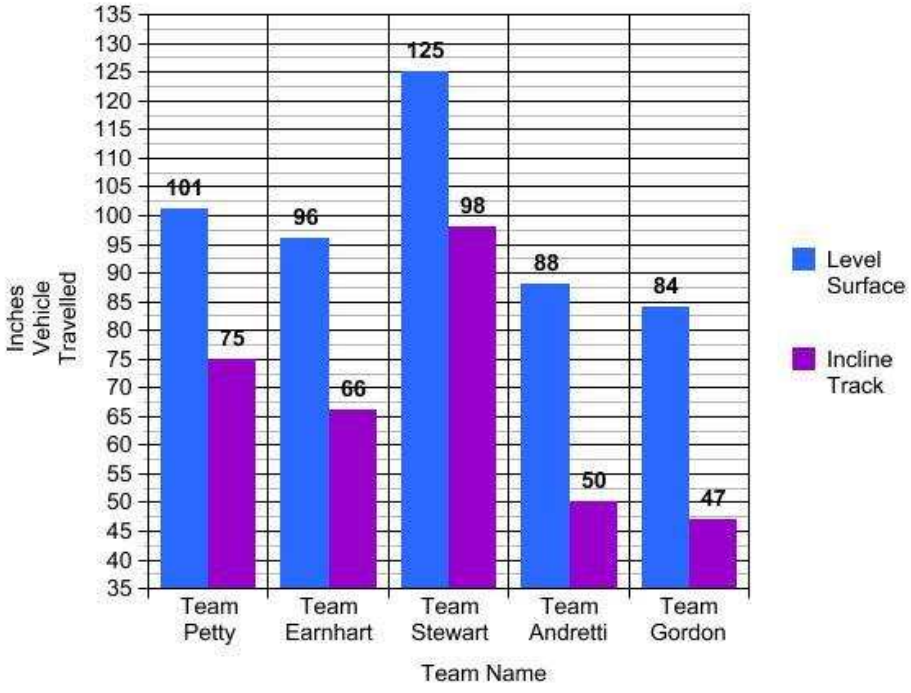
Name _____ Date _____

Assessment: Bar Graphs

Distance Vehicles Travelled on Level Surface



Distance Vehicles Travelled



Use the single and double bar graphs in order to answer the following questions:

1. How much farther did Team Petty travel than Team Gordon on a level surface?

(101+75) – (84+47) = 45 inches

2. What is the combined distance of the two teams who travelled the shortest distance on the inclined track? **50+47=97 inches**

3. What is the difference between the longest distance travelled on a level surface and the shortest distance travelled on an inclined track? **125-47= 78 inches**

4. Which team's vehicle traveled the farthest on the level surface? **Team Stewart**

5. How much farther did Team Stewart's vehicle travel on a level surface compared to an inclined track? **125-98=27 inches**

Sample BCR Response

Step A

What is the typical distance a vehicle travelled on an inclined track? Explain which type of average you used and explain why this makes sense.

The typical distance on an inclined track is 73 inches. I used the mean to determine my answer because it is the most logical method to calculate the average distance for all 5 teams.

Step B

Explain why your answer is correct (OR HOW YOU FOUND YOUR ANSWER).
Use what you know about interpreting data in your explanation.
Use math vocabulary words and/or numbers in your explanation.

75+66+98+50+47=366 366÷5= 73 inches
I found my answer by adding up all of the distances for the 5 teams on the inclined track. Then I divided the sum by 5, which is the total number of teams (addends.) I rounded my answer to the nearest whole number.